

Project Report

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An Approach to the Reuse of Technical Materials for Educational Purposes

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Introduction

This project addresses the problem of transforming technical documents intended for a technical audience into educational materials directed toward segments of the general public. In particular it addresses the conversion of technical material into Internet based educational materials. A major consideration of the project is the conservation of the time of subject matter experts in the organization in recognition of the fact that such experts are likely to be more valuable to the organization for purposes other than the production of educational outreach.

Technical organizations produce large numbers of electronic technical documents in support of their missions. When such an organization has a need to explain itself to an outside audience, the materials in their existing forms are very nearly useless. These documents, ranging from proposals to reports to presentations, almost always address a technical audience. They presume prior subject matter, and program-related, knowledge lacking in the outside audience, and are riddled with acronyms and terminology confusing even to insiders.

Additionally, the format of an outreach document is probably not that of a technical report or a proposal or even a slideshow presentation. The technical report is not composed with an eye to interesting or educating an audience unfamiliar with its material and for similar reasons a proposal is not an appropriate vehicle. Slideshow presentations appear to be the most likely documents for reuse, but they cannot function as outreach documents without significant modification. The electronic slideshow, intended to augment a live presentation, cannot by itself be a substitute for the whole presentation. Even if the narration of the original slideshow were supplied, the difference in background and educational level between the original audience and the outreach audience would prevent the narrated show from being effective. In addition, the presentation may contain details of little interest to an outside audience, such as

budgets and timelines. Even so, these types of material are likely to contain information and elements useful in the outreach document. One significant problem therefore is to discover protocols or methodologies for automating or facilitating the transformation of technical materials into outreach components.

The task of reworking technical documents cannot proceed without the active participation of a content expert. The expert is needed at a minimum to explain the overall project being presented as outreach, provide the information missing in the documents, and validate the final product. The content expert's time is a valuable commodity and the creation of outreach documents is likely to be a task of relatively low priority compared with the demands of on-going projects. The second major problem then is the effective and convenient use of the content expert's time.

In the remainder of this paper we will speak as though there were only two people involved in the development of the outreach material, a web site developer and a subject matter expert. In fact the developer has at least two distinct roles, that of designing the web site and that of implementing the design. Likewise the subject matter expert is portrayed here in the additional role of the client who has the power to approve and sign off on various stages of a project. Other people could well fill these roles and others. Also, in what follows, the term 'project' is potentially ambiguous. Sometimes it may refer to the website development project and sometimes it may refer to the technological project about which the website project reports. Where necessary for clarity these two projects will be called the 'website project' and the 'technical project' respectively.

Development Process

The process is modeled on common software development processes, specialized by the orientation to outreach and education on the one hand and web site development on the other. The process steps include the development of an overall project plan setting forth the functional and non-functional requirements and acceptance criteria; an instructional analysis determining learning objectives, capabilities and limitations of the audiences (intended students and, if appropriate, teachers) for the products of the project; an overall website design including a graphic template and navigation strategy accompanied by an illustrative prototype; the creation and revision of the instructional website and ancillary materials; and the publication of the site. The process is informed by the secondary objective of making effective use of the time of the SME. The development of the overall project plan will involve more of the SME's participation than any other because the designer, who will translate from the technical language of the existing documents to a form understandable by the intended audiences, must herself understand the science and technology of the underlying project and the SME must be confident of the designer's understanding. The phase of the process by which the designer becomes educated should therefore receive special attention. Its objectives are not only to educate the designer but to get the SME to buy into the project. The designer's education will occur in two parts. First the SME will provide the technical documents to the designer for her review. Second the SME will meet with the designer

to explain the project. Thereafter the interaction between the designer and the SME will be conducted asynchronously via the annotation tool described below. The designer will create a website, not intended for publication, but which provides a high level sketch of the science, technology, aims and benefits of the technical project. By use of the tool the SME will correct misunderstandings, provide amplifications, answer questions, and approve the high level translation from technical to lay language, all in an asynchronous mode.

The overall-planning phase will also determine the functional and non-functional requirements of the project. The requirements will identify the science, technology, goals and benefits of the technical project which are to be explained; the audiences, such as highschool or college students and teachers; the types of interaction to be provided on the site; and the ancillary materials to be made available. The interactions include such things as static web pages, simple or complex animations, streaming video or audio, self-assessments, interactive tutorials and the like. The ancillary materials may include a selection of the technical documents on which the site is based, curriculum plans for teachers, assessment instruments or strategies and the like. These aspects of the planning phase can also be negotiated via the annotation tool. Thus the planning phase will involve the interactive construction of two websites, one outlining the designer's understanding of the technical project and one developing the project plan and requirements.

The final aspect of the planning phase involves the recruiting of members of the intended audiences who will review the development at stages indicated below. It is particularly important to recruit teachers.

The instructional analysis phase will require the attention of the SME since the instructional designer moves from the high level overview of the previous phase to the lower level details of the content actually to be conveyed and the SME is needed to correct or certify the technical content of the analysis. In this phase the designer determines the learning goals and objects for the site, the sequencing of the instruction, and a detailed outline of the content. In addition the designer determines the background knowledge needed by the audiences to understand the material and devises strategies for overcoming any lack. If the website project is to include materials for teachers or self-assessments for the audience, the composition of assessment items will take place at this time. In addition to the reviews by the SME, the teachers recruited during the planning phase should assess the products of the instructional analysis. All of this material can be reviewed interactively and asynchronously using the annotation tool.

The production of the website itself requires an overall plan for the look and feel of the site: the graphic templates that create a unifying theme and the navigation strategy by which the users will traverse the site. After an initial design is approved by the SME, the designer will build a small prototype site to be reviewed by the SME and the recruited students and teachers. The website project may also involve a separate site for teachers and, if so, should be reviewed in a similar fashion.

All of this leads to the development of the actual website. This is naturally an iterative process facilitated by the annotation tool. The SME must certify the correctness of the designer's final translation and students and teachers are needed to evaluate the usability of the site. Similar interaction is required for the construction of any separate site for teachers.

Finally the sites will be copied to their publication addresses, reviewed and approved by the SME.

The elaboration and validation of this approach is currently being developed as a Ph. D. thesis at the University of Central Florida by Terrance Buckner who participated in the current project as an instructional designer.

The Annotation Tool

Specifications were developed for a software tool to assist in the development of the websites. The purpose of the tool is two-fold:

1. To manage the dialog between the site developer/instructional designer on the one hand and the subject matter expert, teachers, and students on the other.
2. To manage the versioning of the site so that the development process becomes visible under review and so that earlier versions and language may be retrieved if desired.

Dialog between Designer, Expert and Audience

In most of the phases described above, there was a requirement for an asynchronous dialog between the developer and someone else, the subject matter expert or an evaluating teacher or student, concerning some document. The designer uses the dialog to get confirmations of correctness, corrections, approval, and evaluations. For example, one of the designer's aims is a translation of technical concepts into an expression that can be understood by the target audience of the site. That translation must be validated by the SME. Again, both the overall architecture and its more detailed structure must be approved by the SME (in the role of customer) before the designer can proceed with detailed development. Later, the SME is needed to ensure that the actual expression of the scientific and technical concepts is correct and, again in the role of customer, to approve the presentation of the website. Participating teachers and students must have a means to comment on the content, structure, and navigation of the site. All of these tasks require dialog which is focussed on conceptual, planning, or production documents.

Since a major goal of this project is to make effective use of the time of the SME, our intent was to facilitate an asynchronous dialog about the documents of the project, whether planning or production. Thereby the need for face-to-face meetings could be reduced and the SME would be able to participate at any free moment. Consequently we developed a document-centric, web-based annotation tool. The main goals of the tool are

1. To enable either party to add comments to a dialog about the document in question.
2. To present a history of the dialog so that the conversation can be reviewed.
3. To present the document in its current form with the tool so that the document is visibly available while the dialog is being reviewed and extended by either party.
4. To keep the document and the commentary physically separate although they are presented together. The annotation tool is not intended as a development environment. The designer should be free to use any content creation tools she desires. The designer should not have to do anything to the code of a page to make it amenable to the annotation tool. This goal also implies that the site can be viewed with or without the tool at any time.
5. To maintain the tool as context as the user traverses links from page to page. The tool will display the dialog history for each new page as it is visited.

Toward these ends, we developed a tool that presents an HTML page in association

with two commentary areas. One area presents the history of the commentary. The other allows the participant to add comments and continue the asynchronous dialog. The annotations are kept in a database that associates the commentary with the URL of the document. When the tool is instructed to retrieve the URL, it retrieves the associated commentary (see Figure 1). In addition when the links on the page are followed, the target URL is presented within the tool. The user of the tool is thus able to view the page and its context while reviewing the development dialogs associated with the site.

Figure 1: Subject web page on the right, comments on the left

Versioning

One natural result of the dialogs we are envisioning is that changes will be made to the web page. When the changes are small the document is in some sense the same document. But when major changes are installed we have a new version of the document. The identification of what counts as a new version should be left up to the decision of the designer, but the essential fact about a new version is that the old version should be kept available in case the old version turns out to be preferable, in case there is something useful on the page that might be retrieved in the future, or in case the sequence of pages is needed to provide a context for the dialog preserved about the page. The ability to create and retrieve versions is also desirable when a choice is to be made among several alternatives. It is desirable to be able to view alternatives and navigate back and forth between them.

Consequently we have added a versioning capability to the requirements of the annotation tool. One version of a page is always identified as the current version and is available at the website. Other versions are stored in the database. The designer uses the tool to upload a new web page to the site and designate it as a new version or a

minor change of an existing page or as a new page. To view another version, the tool retrieves the appropriate page from the database.

The addition of versioning adds complexity to the status of the stored comments concerning a page. Each version of the page may have associated comments, but comments on other versions may be relevant as well. Therefore the user has a choice of viewing the comments which apply to the current version only or to view all comments which apply to any version of the page.

The development of the annotation tool is currently the subject of the Master's project of Venkat Varkala at Old Dominion University.

Conclusion

We have developed a process for the transformation of technical materials into educational websites. We have also developed a tool which supports interactive asynchronous dialog about and versioning of the web pages in the development effort. The tool can be used in all phases of the project: planning, instructional analysis and development. In developing the tool, we have come to realize that in future releases the principle of versioning should be applied to sets of related pages rather than to single pages.